least one frequency **inherently present** in the physical catalyst (see Claim 1). The frequencies that are inherently present in a physical catalyst can be determined by conventional spectroscopy techniques, many of which are disclosed in the present specification at pages 11-16 (e.g., absorption and emission spectra as well as, for example, microwave spectroscopy, radio spectroscopy and Raman spectroscopy). The claimed exposure of the claimed frequency (i.e., the claimed spectral catalyst in Claim 1) to the claimed reaction system results in the claimed augmentation (e.g., increasing or decreasing) of the performance of the physical catalyst in the reaction system.

Conventional spectroscopy techniques provide useful information to assist in the practice or implementation of the claimed invention. In particular, most of the disclosed spectroscopy techniques, or their equivalents, can result in a relationship between frequency and amplitude (or counts) that can be depicted, for example, graphically. Stated very simply, a standard spectroscopy approach can involve the application of a specific set of frequencies (usually plotted on the x-axis) to a substance and the substance will either absorb or emit energy (detectable counts usually plotted on the y-axis) that vary as a function of the frequency. Such variance can be shown graphically as a combination of peaks and valleys of differing heights on the y-axis, which are a direct function of detectable output signal(s) from the sample exposed to the different frequencies.

The invention as set forth in, for example, independent Claim 1 makes use of the data from conventional spectroscopy techniques in the novel claimed manner. Specifically, once a "peak" (or combination of peaks, which represent a partial or complete spectral pattern) has been determined, that peak or combination of peaks is duplicated and exposed to the reaction system. Independent Claim 13 contains similar words and similar steps to those recited in Claim 1, but also claims expressly the use of at least one harmonic frequency and/or at least one frequency which copies at least one mechanism of action of the physical catalyst.

The claimed exposing of the reaction system to the claimed frequency (or frequencies) results in an augmentation of the physical catalyst. A simple example of the performance of a physical catalyst being enhanced is set forth in Example 5. Specifically, Example 5 at page 27, line 15 – page 28, line 6, discloses the augmenting of a platinum physical catalyst with a spectral pattern created by a hollow cathode platinum lamp. The specification at page 27, lines 27-30 specifically discloses augmenting a physical platinum catalyst with a platinum spectral catalyst

which is created by the emissions from the hollow cathode platinum lamp (i.e., a conventional lamp purchased from Fisher Scientific). In this example, the lamp emits an energy pattern that corresponds in large part to the emission spectroscopy pattern of platinum. With regard to Claim 1, the emissions from the lamp correspond to "said at least one frequency of said duplicated electromagnetic spectral pattern" (emphasis added). Thus, the reaction system comprising hydrogen and oxygen gasses and physical platinum catalyst was exposed to the claimed **"said at least one frequency of said duplicated electromagnetic spectral pattern thereby augmenting said at least one physical catalyst".** By exposing the reaction system to the spectral pattern of platinum created by the lamp (e.g., the energy and visible light emitted by the lamp) the specification discloses that there was **a mean increase in reaction rate of approximately 60%** (see page 28, lines 3-6).

For the convenience of the Examiner, pending independent Claims 1 and 13 are reproduced below:

1. A method for augmenting at least one physical catalyst in a chemical reaction system with at least one spectral catalyst comprising the steps of:

a) determining an electromagnetic spectral pattern of said at least one physical catalyst;

b) duplicating at least one frequency of said electromagnetic spectral pattern of step (a) with at least one electromagnetic energy emitter source; and

c) exposing said chemical reaction system to said at least one frequency of said duplicated electromagnetic spectral pattern thereby augmenting said at least one physical catalyst.

13. A method for augmenting at least one physical catalyst in a chemical reaction comprising the steps of:

a) determining at least one frequency selected from the group of frequencies consisting of (a) at least one frequency of a duplicated electromagnetic pattern of said at least one physical catalyst, (b) at least one harmonic frequency of an electromagnetic pattern of said at least one physical catalyst and (c) at least one frequency which copies at least one mechanism of action of said at least one physical catalyst ; and

b) exposing said chemical reaction system to said at least frequency from said group of frequencies, said exposing being sufficient to augment said at least one physical catalyst.

The pending independent claims do not recite the discovery of spectroscopy, but rather use the well known science of spectroscopy to assist in determining useful spectral patterns. The pending independent claims do not recite the discovery of any particular material as a catalyst, but rather use a spectral frequency (e.g., a frequency that is inherent in the physical catalyst (Claim 1) or at least one frequency which is a harmonic of an electromagnetic pattern of the physical catalyst or at least one frequency which copies the mechanism of action of the physical catalyst (Claim 13)) to augment a physical catalyst.

Applicants respectfully submit that the pending claims meet all requirements of being definite under 35 U.S.C. 112 and are not subject to random interpretation.

With regard to the two articles from Science, Volume 302 previously provided to the Examiner, these articles were provided for one specific reason....to show the Examiner that the statements contained in the first action regarding **"the well established field of kinetics" is no longer a certain as recently believed.** Specifically, these articles are representative of numerous articles now being published which recognize that the old "kinetics" or "statistical" models simply do not fit the new experimental data. These articles provide a challenge to the existing kinetic or statistical models which clearly show that the current models are incomplete. Beck et al. disclose data that show for the same "two quanta" of energy provided to their reaction system, the conversion outputs were as much as 5 times different from each other. In other words, their observed reactions which utilized almost identical amounts of energy produced widely differing results depending on the frequency of the energy provided. Applicants did not bring these articles to the attention of the Examiner to support expressly the metes and bounds of Applicants' claims (because they do not). Rather, Applicants have challenged a portion of the "conventional theory" in this patent application. The conventional theory clearly lacks an understanding of the importance of frequency specific or mode specific effects as exposed by Beck et al. Applicants have provided a large piece of that puzzle, which is clearly recited in the pending claims.

The pending claims were rejected under 35 U.S.C. 101 and 112. Applicants respectfully request that these rejections be withdrawn in view of the above comments.

The pending claims were also rejected under 35 U.S.C. 103(a) over the eight (8) references of record. This rejection is respectfully traversed.

The Action misstates the position of the Examiner, but Applicants believe that they understand what was meant from a previous Action. Specifically, The "primary references" do not **all** establish the photochemical reaction of hydrogen and oxygen with a platinum electrode. Rather, the references to Gdowski, Mitchell, Mitchell, Verheij and Verheij all disclose **various surface chemistry reactions** between hydrogen, oxygen and solid platinum. None of these five references refers to photochemistry at all. Photochemistry is broadly known as the study of the effects of light on chemical reactions.

The two references to Volman do appear to be related to photochemistry techniques. These references disclose certain complicated photochemical reactions that result in different amounts of **"ozone, hydrogen peroxide and water"** being produced after exposing certain starting gasses to a **"mercury-rare gas low-pressure discharge tube"** (see pages 289-290 of Volman I). The light emitted by the mercury lamp: **"is limited almost entirely to the 2357 and 1849 A (Angstrom) resonance lines of mercury"**. Various flow rates and pressures of gases are disclosed as producing different ratios of the **three** products produced. Various assumptions are made by Volman el al. regarding the role that the mercury light source may have in the production of hydrogen peroxide, ozone and water, all of which are **produced and measured.** Accordingly. the Volman references clearly teach the use of a mercury lamp to produce ozone, hydrogen peroxide and water.

The reference to Sansonetti et al. discloses the well known spectrum of a platinum hollow-cathode lamp (with a neon carrier gas) quite similar to the lamp disclosed in Example 5 of the present specification. Numerous other spectroscopic data of like value are reported in many locations in the literature.

The action suggests that all of the aforementioned references can be combined by using something other than hindsight: "Hence this is not hindsight, but a recognition of the fundamental nature of the photochemical reaction" (see page 5 of the Action). Applicants must respectfully disagree. There simply is no motivation to combine a first series of references disclosing surface chemistry reactions involving solid platinum, oxygen and hydrogen-----with a

second series of references disclosing complicated gaseous photochemistry reactions that result in the production of ozone, hydrogen peroxide and water by using, as a light source, a mercury-rare gas low-pressure discharge tube producing primary frequencies of 2357 and 1849A (with the frequency of 2357A playing an uncertain role in the reaction)-----with a third reference that gives the spectrum of a platinum/neon hollow-cathode lamp.

Applicants respectfully submit that the aforementioned references have very little in common even in view of Applicants' claimed invention. The Action has chosen selected portions of each reference and not used the disclosure of each reference as whole. These references simply would not be combined absent Applicants' own teachings.

The discovery underlying what is defined by the pending claims is a paradigm shift in the understanding of catalysis mechanisms. Specifically the underlying discovery shows that catalysis is much more than mere kinetics and statistics. Others are now beginning to recognize certain frequency specific effects (see Science, Volume 302, referenced above). Catalysis **is** frequency specific. In the claimed invention, the function of the physical catalyst is augmented by a spectral catalyst. At its best, photochemistry excites reactants. Applicants respectfully submit that the Examiner will never find any prior art reference alone or any combination of prior art references that recognize the paradigm shift embodied by the pending claims.

Applicants respectfully request a favorable action on the merits of the Application and a Notice of Allowance directed to claims 1-4 and 7-15.

Respectfully submitted,

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